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NOTES

THE WORLD'S PRODUCTION OF GOLD AND SILVER FROM 1493 TO 1905

The following tables are an attempt at a statement, as accurate as possible, of the world's production of gold and silver, by weight and by value, from 1493 to 1905. No figures are given after 1905, because there are changes in the estimates of recent years as fuller reports come in.

To 1885, the figures of these tables are based on Soetbeer; after that date, on the reports of the Director of the United States Mint. Beginning in 1873, the Director of the United States Mint has annually made an estimate of the production of gold and silver in the world for the preceding year, and a tabulation of these estimates has been included in his annual report. Starting with the report of 1896, however, another table, giving the production of gold and silver from the discovery of America, has been included. This last table has been based on the figures of Soetbeer to 1885 and on those of the Director of the United States Mint for subsequent dates. In the reports of 1905 and following years, the first table, giving the annual estimates of the Director of the United States Mint from 1873 to 1885 and thereafter, has been dropped. That fact would seem to support the method of the present compilation, in which Soetbeer's figures exclusively have been followed up to 1885; although too much emphasis must not be laid on the omission of this table, as it is still published in the volume on the *Production of the Precious Metals* issued by the Director of the United States Mint. No reference is given by the directors of the mint, in their reports, to the exact place in Soetbeer's writings from which the figures are taken. An examination of the figures has convinced me that Soetbeer's revised figures (since 1880) have not been used.

In the following tables for the years from 1493 to 1880, the annual averages are taken from *Materialien zur Erläuterung und Beurteilung der wirtschaftlichen Edelmetallverhältnisse und der Währungsfrage*, von Adolf Soetbeer, Zweite vervollständigte Ausgabe, Berlin, 1886, pp. 1-3. For the years from 1881 to 1885, the annual averages are taken from Soetbeer's *Edelmetallgewinnung und Verwendung in den Jahren 1881 bis 1890*, published in Hilde-

brand's *Jahrbücher für Nationalökonomie und Statistik*, Vol. LVI (1891), pp. 537, 538, 561.

Soetbeer's statistics for quantity and value are given, by him, in kilograms and marks. In making the conversion into ounces and dollars the kilogram was taken as 32.1507 ounces and the logarithm of the conversion factor as 1.5071908.¹ The mark was taken as \$0.23821.² With this value, the logarithm of a thousand marks, the unit most used, is 2.3769600.³

In the article in the *Jahrbücher*, Soetbeer discusses the production of gold and silver in the various countries separately, and then brings together the results in tables. He obtains his estimate of the world's production by adding the figures for the separate countries. In the case of the value of gold the unit used is a million marks and the figures for the different countries are given to two decimal places. When he adds these figures to get his totals he drops the decimals and takes the result to the nearest unit. To make the result more accurate, in finding the value of gold for the period from 1881 to 1885, instead of taking Soetbeer's figures in even millions of marks, I have added the columns as he gives them and taken the exact totals.

After the annual averages had been changed into ounces and dollars, the totals for both gold and silver, for the periods, were obtained by multiplying the annual average by the number of years in the period. This was done by ordinary multiplication.

In obtaining the value of the metals, Soetbeer took a kilogram of gold to be worth 2,790 marks. The value of silver Soetbeer derives from three sources. For 1833 and after, the average London price is used; from 1687 to 1832, the average Hamburg price. For the period from 1493 to 1687 the value of silver is based on Soetbeer's own estimates of the ratio of silver to gold for the different periods. These estimates are given in *Materialien*, etc., pp. 22 and 24. In finding the value of the silver, he does not use these precise ratios, but a ratio which gives an even number of marks for the

¹ J. C. Evans, *Physico-Chemical Tables*. London, 1902.

² Tate, *Modern Cambist*, London, 1893, p. 49, gives the weight of ten marks of gold as 61.4589765 grains troy, and the fineness as .900. That would give for each mark 5.531307885 grains of fine gold. Since there are 23.22 grains of fine gold in our dollar, the value of the mark is found to be \$0.23821.

³ Vega's seven-place *Logarithmic Tables* were used in the computation, the sixth significant figure being obtained by interpolation.

value of a kilogram of silver. This is obviously equivalent to a slight change in the ratio. In the table from which I have taken the figures (*Materialien*, p. 1) the value of a kilogram of silver in marks is given for each period. From this, I have computed, to two decimal places, the ratio of silver to gold which was actually used in valuing the silver of the period. The following table gives these average ratios for the periods up to 1850:

Period	Average Ratio	Period	Average Ratio
1493-1520.....	10.73:1	1701-1720.....	15.25:1
1521-1544.....	11.25:1	1721-1740.....	15.08:1
1545-1560.....	11.30:1	1741-1760.....	14.76:1
1561-1580.....	11.48:1	1761-1780.....	14.63:1
1581-1600.....	11.82:1	1781-1800.....	15.08:1
1601-1620.....	12.24:1	1801-1810.....	15.59:1
1621-1640.....	14.02:1	1811-1820.....	15.50:1
1641-1660.....	14.53:1	1821-1830.....	15.76:1
1661-1680.....	15.00:1	1831-1840.....	15.76:1
1681-1700.....	15.00:1	1841-1850.....	15.85:1

In this connection it is interesting to note that in the earlier form of the *Materialien*, which appeared in Petermann's *Mitteilungen*, Ergänzungsheft No. 57 (1879), Soetbeer computed the value of silver at the ratio 15.5:1 for the whole period. The value of silver from 1800 to 1870 had been at about that figure, which was therefore looked upon as a fairly stable quotation for silver. Later, when silver fell rapidly in value, it seemed best to Soetbeer to value the product of each period by the average value for the period; and he did this in the edition of the *Materialien* which I have used.

After 1885, the figures for the annual production are those of the Director of the United States Mint. The figures for both gold and silver, for both weight and value, are taken from the report entitled *Production of Precious Metals for 1907*, p. 43. This was issued by the Director of the Mint in 1908. The commercial value of silver, as given in this report, was evidently obtained by multiplying the number of fine ounces produced, by the value of a fine ounce at the average London quotation for the year. The value to the nearest cent was taken by the Mint.⁴

Since the report for the year 1906 (issued in 1907), the United

⁴In the Reports of the Director of the United States Mint, the column headed "Coining Value" still persists. The meaning is obvious. It tells the number of silver dollars that could be coined out of the given amount of silver. This had some significance during the period from 1878 to 1893, but now it is about as relevant as it would be to tell how many cents could be coined from the year's production of copper.

States Geological Survey has assisted the Director of the Mint in making the estimates of the production of gold and silver in the United States.

The summaries (Tables V and VI) for the quantity of both gold and silver were obtained by adding the totals for the shorter periods which make up the longer ones. The summaries for value are involved in difficulties. In the case of gold the summary for value is determined in the same way as the summary for quantity. But in the case of silver difficulties arise from the fact that the value of silver fluctuates more or less relatively to gold, in each year, and very widely in the course of years. What value of silver shall we use in summarizing? So far as single years are concerned, evidently the year's production should be valued at the average value for the year. For longer periods shall we follow the same method and find the total value of the period by multiplying the total product of the period by the average price during that period? Or shall we take the total product of the period and multiply it by the average price of the last year of the period? Or shall we merely add the values of the shorter periods which make up the longer one? To make the distinction more concrete, let us take as an example the period from 1886 to 1890. If we add the totals of the years in order to obtain the total for the period, it amounts to \$533,361,500. If we multiply the product of the period in ounces, by the average value of an ounce for the period, we get \$533,154,286. If we multiply the product of the period in ounces by the average value of an ounce for the last year of the period we get \$569,791,934. If our interest is in the values throughout the period as a whole, we should probably take one of the first two methods. If our interest is in the situation at the end of the period, we should probably take the last method. However, the important thing is to understand how the results were obtained so that we may be able to interpret them.

The column in Table VI headed Silver A was obtained by adding the totals for the shorter periods which make up the longer periods. It gives the total value of silver produced, taking the value at the time of production. The column headed Silver B was obtained by multiplying the number of ounces produced in the period by the average price of a fine ounce of silver for the year ending the period, as given in the *Production of the Precious Metals for 1907*, p. 122. The price used is the London quotation. This, then, gives the value of the silver produced in a given period, at the price current at the end of the period.

TABLE I
PRODUCTION OF GOLD BY PERIODS (1493-1875)

PERIOD	OUNCES		VALUE	
	Annual Average	Total	Annual Average	Total
1493-1520. . . .	186,474	5,221,272	\$ 3,854,710	\$ 107,921,880
1521-1544. . . .	230,199	5,524,776	4,758,480	114,183,520
1493-1544. . . .		10,746,048		222,105,400
1545-1560. . . .	273,603	4,377,648	5,655,580	90,489,280
1561-1580. . . .	219,911	4,398,220	4,545,760	90,915,200
1581-1600. . . .	237,272	4,745,440	4,904,850	98,097,000
1601-1620. . . .	273,924	5,478,480	5,662,490	113,249,800
1545-1620. . . .		18,999,788		392,751,280
1621-1640. . . .	266,851	5,337,020	5,516,230	110,324,600
1641-1660. . . .	281,962	5,639,240	5,828,520	116,570,400
1661-1680. . . .	297,716	5,954,320	6,154,160	123,083,200
1681-1700. . . .	340,103	6,922,060	7,154,400	143,088,000
1701-1720. . . .	412,172	8,243,440	8,520,300	170,406,000
1721-1740. . . .	613,436	12,268,720	12,680,600	253,612,000
1741-1760. . . .	791,231	15,824,620	16,356,000	327,120,000
1761-1780. . . .	665,681	13,313,620	13,760,700	275,214,000
1621-1780. . . .		73,503,040		1,519,418,200
1781-1800. . . .	571,961	11,439,220	11,823,300	236,466,000
1801-1810. . . .	571,576	5,715,760	11,815,200	118,152,000
1781-1810. . . .		17,154,980		354,618,000
1493-1810. . . .		120,403,856		2,488,892,880
1811-1820. . . .	367,965	3,679,650	7,606,520	76,065,200
1821-1830. . . .	457,055	4,570,550	9,448,120	94,481,200
1831-1840. . . .	652,306	6,523,060	13,484,100	134,841,000
1841-1850. . . .	1,760,540	17,605,400	36,393,000	363,930,000
1811-1850		32,378,660		669,317,400
1493-1850. . . .		152,782,516		3,158,210,280
1851-1855. . . .	6,410,470	32,052,350	132,518,000	662,590,000
1856-1860. . . .	6,486,410	32,432,050	134,089,000	670,445,000
1861-1865. . . .	5,949,720	29,748,600	122,994,000	614,970,000
1866-1870. . . .	6,270,230	31,351,150	129,619,000	648,095,000
1851-1870. . . .		125,584,150		2,596,100,000
1871-1875. . . .	5,591,140	27,955,700	115,581,000	577,905,000

TABLE II
PRODUCTION OF GOLD BY YEARS (1876-1905)

PERIOD	OUNCES		VALUE	
	Annual	Total	Annual	Total
1876.....	5,335,610		\$110,298,000	
1877.....	5,769,290		119,252,000	
1878.....	5,975,120		123,517,000	
1879.....	5,379,040		111,196,000	
1880.....	5,257,130		108,675,000	
1876-1880....		27,716,190		\$ 572,938,000
1881.....	5,165,910		106,787,000	
1882.....	4,945,330		102,228,000	
1883.....	4,777,080		98,947,700	
1884.....	5,007,410		103,502,000	
1885.....	5,014,610		103,655,000	
1881-1885....		24,910,340		515,119,700
1886.....	5,135,679		106,163,900	
1887.....	5,116,861		105,774,900	
1888.....	5,330,775		110,196,900	
1889.....	5,973,790		123,489,200	
1890.....	5,749,306		118,848,700	
1886-1890....		27,306,411		564,473,600
1891.....	6,320,194		130,650,000	
1892.....	7,094,266		146,651,500	
1893.....	7,618,811		157,494,800	
1894.....	8,764,362		181,175,600	
1895.....	9,615,190		198,763,600	
1891-1895....		39,412,823		814,735,500
1896.....	9,783,914		202,251,600	
1897.....	11,420,068		236,073,700	
1898.....	13,877,806		286,879,700	
1899.....	14,837,775		306,724,100	
1900.....	12,315,135		254,576,300	
1896-1900....		62,234,698		1,286,505,400
1901.....	12,625,527		260,992,900	
1902.....	14,354,680		296,737,600	
1903.....	15,852,620		327,702,700	
1904.....	16,804,372		347,377,200	
1905.....	18,396,451		380,288,700	
1901-1905....		78,033,650		1,613,099,100

TABLE III
PRODUCTION OF SILVER BY PERIODS (1493-1875)

Period	OUNCES		VALUE	
	Annual Average	Total	Annual Average	Total
1493-1520. . . .	1,511,080	42,310,240	\$ 2,910,930	\$ 81,506,040
1521-1544. . . .	2,900,000	69,600,000	5,328,760	127,890,240
1493-1544. . . .		111,910,240		209,396,280
1545-1560. . . .	10,018,200	160,291,200	18,338,800	293,420,800
1561-1580. . . .	9,629,140	192,582,800	17,336,700	346,734,000
1581-1600. . . .	13,468,900	269,378,000	23,549,400	470,988,000
1601-1620. . . .	13,596,500	271,930,000	22,968,400	459,368,000
1545-1620. . . .		894,182,000		1,570,510,800
1621-1640. . . .	12,654,500	253,090,000	18,658,000	373,160,000
1641-1660. . . .	11,776,700	235,534,000	16,753,300	335,066,000
1661-1680. . . .	10,834,800	216,696,000	14,931,500	298,630,000
1681-1700. . . .	10,992,700	219,854,000	15,148,500	302,970,000
1701-1720. . . .	11,432,800	228,656,000	15,501,500	310,030,000
1721-1740. . . .	13,863,400	277,268,000	19,002,500	380,050,000
1741-1760. . . .	17,141,100	342,822,000	24,003,000	480,060,000
1761-1780. . . .	20,986,100	419,722,000	29,543,000	590,860,000
1621-1780. . . .		2,193,642,000		3,070,826,000
1781-1800. . . .	28,263,100	565,262,000	38,739,100	774,782,000
1801-1810. . . .	28,747,600	287,476,000	38,126,200	381,262,000
1781-1810. . . .		852,738,000		1,156,044,000
1493-1810. . . .		4,052,472,240		6,006,777,080
1811-1820. . . .	17,386,100	173,861,000	23,187,100	231,871,000
1821-1830. . . .	14,807,300	148,073,000	19,418,600	194,186,000
1831-1840. . . .	19,176,300	191,763,000	25,148,300	251,483,000
1841-1850. . . .	25,090,900	250,909,000	32,718,900	327,189,000
1811-1850. . . .		764,606,000		1,004,729,000
1493-1850. . . .		4,817,078,240		7,011,506,080
1851-1855. . . .	28,489,200	142,446,000	38,117,000	190,585,000
1856-1860. . . .	29,096,100	145,480,500	32,235,300	161,176,500
1861-1865. . . .	35,402,800	177,014,000	47,477,200	237,386,000
1866-1870. . . .	43,052,600	215,263,000	57,098,000	285,490,000
1851-1870. . . .		680,203,500		874,637,500
1871-1875. . . .	63,318,400	316,592,000	82,098,800	410,494,000

TABLE IV
PRODUCTION OF SILVER BY YEARS (1876-1905)

PERIOD	OUNCES		VALUE	
	Annual	Total	Annual	Total
1876.....	74,711,200		\$ 86,906,900	
1877.....	76,795,600		92,176,700	
1878.....	82,028,200		94,202,800	
1879.....	80,618,200		90,791,600	
1880.....	79,733,800		90,977,200	
1876-1880....		393,887,000		\$455,055,200
1881.....	83,164,300		94,283,500	
1882.....	87,871,100		99,595,600	
1883.....	80,240,800		99,190,600	
1884.....	93,568,300		103,979,000	
1885.....	97,609,600		104,050,000	
1881-1885....		451,454,100		501,098,700
1886.....	93,297,290		92,793,500	
1887.....	96,123,586		94,031,000	
1888.....	108,827,606		102,185,900	
1889.....	120,213,611		112,414,100	
1890.....	126,095,062		131,937,000	
1886-1890....		544,557,155		533,361,500
1891.....	137,170,919		135,500,200	
1892.....	153,151,762		133,404,400	
1893.....	165,472,621		129,119,900	
1894.....	164,610,394		104,493,000	
1895.....	167,500,960		109,545,600	
1891-1895....		787,906,656		612,063,100
1896.....	157,061,370		105,859,300	
1897.....	160,421,082		96,252,700	
1898.....	169,055,253		99,742,600	
1899.....	168,337,453		101,002,600	
1900.....	173,591,364		107,626,400	
1896-1900....		828,466,522		510,483,600
1901.....	173,011,283		103,805,700	
1902.....	162,763,483		86,264,700	
1903.....	167,689,322		90,552,200	
1904.....	164,195,266		95,233,300	
1905.....	172,317,688		105,113,700	
1901-1905....		839,977,042		480,969,600

TABLE V
SUMMARY OF PRODUCTION OF GOLD AND SILVER BY WEIGHT

PERIOD	OUNCES	
	Gold	Silver
1493-1850.....	152,782,516	4,817,078,240
1851-1875.....	153,539,850	996,795,500
1876-1895.....	119,345,764	2,177,804,911
1896-1905.....	140,268,348	1,668,443,564
1493-1875.....	306,322,366	5,813,873,740
1851-1895.....	272,885,614	3,174,600,411
1493-1895.....	425,678,130	7,991,678,651
1493-1905.....	565,936,478	9,660,122,215

TABLE VI
SUMMARY OF PRODUCTION OF GOLD AND SILVER BY VALUE

Period	Gold	Silver A	Silver B
1493-1850.....	\$ 3,158,210,280	\$ 7,011,506,080	\$6,339,274,964
1851-1875.....	3,174,005,000	1,285,131,500	1,238,348,954
1876-1895.....	2,467,266,800	2,101,578,500	1,424,415,080
1896-1905.....	2,899,604,500	991,453,200	1,018,201,054
1493-1875.....	6,332,215,280	8,206,637,580	7,222,749,763
1851-1895.....	5,641,271,800	3,386,710,000	2,076,379,145
1493-1895.....	8,799,482,080	10,398,216,080	5,227,037,338
1493-1905.....	11,699,086,580	11,389,669,280	5,895,282,784

J. D. MAGEE

THE UNIVERSITY OF CHICAGO

WASHINGTON NOTES

RAILWAY REVENUES AND EXPENSES

WORK OF THE MONETARY COMMISSION

DIRECTORAL CONTROL OF BANKS

APPLYING THE CORPORATION TAX

A STUDY OF COTTON SPECULATION

EXPERIENCE TABLES FOR SURETY BONDS

PREPARATIONS FOR THE CENSUS

An important series of new publications has been undertaken by the Interstate Commerce Commission under the direction of its statistical division. These are the Bulletins of Revenues and Expenses of Steam Roads of the United States of which four numbers have now been issued. The first of the series was made public a few weeks ago, after some delay in preparation, and has been quickly followed by three others. Included in each number of the *Bulletin* is a "System Index and Mileage Table" intended to supply